

All dimensions are in mm. Drawing not to scale. Pins facing downward view.

Motor – sensor configurations					
Sensor	Motor				
	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	Ⓢ		Ⓢ	Ⓢ	
Incr. Encoder + Dig. Hall	Ⓢ	Ⓢ			
Digital Halls control only	Ⓢ				
Tacho			Ⓢ		
Open-loop (no sensor)				Ⓢ	Ⓢ

Mating Connectors			
Producer	Part No.	Connector	Description
Samtec	SQW-117-01-F-D(-VS)	J1	2x17, 2.0mm THT (SMD) socket
	CLT-117-02-F-D		2x17, 2.0mm SMD pass-through socket
	SQW-110-01-F-D(-VS)	J2	2x10, 2.0mm THT (SMD) socket
	CLT-110-02-F-D		2x10, 2.0mm SMD pass-through socket

- **Features**
- Motion controller and drive in a single compact unit based on MotionChip™ technology
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- Advanced motion control features, including CSP, CSV, CST, PVT, S-curve, electronic gearing, camming, and more.
- Motor supply: 48V nominal
- Motor output current:
 - Nominal: 4.5A_{RMS} / 6.3A amplitude for PMSM motors
 - 5.5A for DC / BLDC / Step motors
 - Peak: 11.3A_{RMS} / 16A amplitude
- Logic supply: 24V nominal, 48V max
- Feedback can be:
 - 1 x Hall sensor interface (digital)
- Feedback: Incremental A / B (index Z available): differential or single-ended;
- 3 x digital inputs: 2 for limit switches + one Enable, NPN, pull-up on-board to +5V. Pull to GND to activate.
- 3 x configurable I/Os, each software selectable as:
 - Digital input, NPN, with pull-up on-board to +5V. Pull to GND to activate;
 - Digital output, NPN (open-collector), with pull-up on-board to +5V. Sink current: 1 x 1.5A to drive inductive loads (such as mechanical brake), 2 x 0.1A.
- 3 x digital inputs: 2 for limit switches + one Enable, NPN, pull-up on-board to +5V. Pull to GND to activate.
- Communication interfaces: USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols
- 24Kwords E²ROM to store setup data, TML motion programs, cam tables and other user data
- 16Kwords SRAM memory for data acquisition
- Operating ambient temperature: 0-40°C (over 40°C with de-rating)
- Programmable protections: any short-circuit between motor phases, GND and/or supply, over/under-voltage, over-current, I²t drive & motor, control error
- 3 AxisID inputs, for hardware-based address setting
- >98% voltage efficiency, >98% power efficiency

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Pin	Name	Type	Description
1	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V _{DC}
2	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
3	GND	-	Ground return for logic supply
4	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
5	GND	-	Ground return for motor supply & shield for motor windings cable
6	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
7	+Vmot	I	Positive terminal of the motor supply: 7 to 48 VDC
8	Cr/B-	O	Chopping resistor / Phase B- for 2-ph steppers
9	BFS	I	Boot Fail-Safe: Connect to GND to reprogram firmware in the improbable case when a power loss occurs during a firmware update and the normal firmware recovery fails
10	ID2	I	AxisID2 selection pin. See AxisID register settings table.
11	...		
14	Rsvd.	-	Reserved. Do not connect.
15	GND	-	Ground return and shield
16	GND	-	Ground return and shield
17	...		
20	Rsvd.	-	Reserved. Do not connect.
21	ID0	I	AxisID0 selection pin. See AxisID register settings table.
22	ID1	I	AxisID1 selection pin. See AxisID register settings table.
23	TTL2TX	O	TTL 232 Data Transmission (low-voltage TTL)
24	TTL2RX	I	TTL 232 Data Reception (low-voltage TTL)
25	CAN Hi	O	CAN-Bus positive line (dominant high)
26	CAN Lo	I	CAN-Bus negative line (dominant low)
27	IN2/LSP	I	5-48V digital NPN input. Positive limit switch input
28	IN3/LSN	I	5-48V digital NPN input. Negative limit switch input
29	IN5/Enable	I	5-48V digital NPN input. Drive Enable input
30	I/O0	I/O	5-48V 1.5A NPN (sink) general-purpose digital programmable input IN0 or output OUT0
31	I/O1	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN1 or output OUT1
32	I/O4	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN4 or output OUT4
33	GND	-	Ground return and shield
34	AnalogIn	I	Analog input (range software selectable 0-5V or ±10V)

Pin	Name	Type	Description
1	+V USB	I	USB 5V detect input
2	GND	-	Ground return for USB
3	Hall1	I	Digital Hall, or Linear Hall sensor 1
4	Hall2	I	Digital Hall, or Linear Hall sensor 2
5	Hall3	I	Digital Hall, or Linear Hall sensor 3
6	GND	-	Ground return and shield
7	+5V	O	Supply for all feedback sensors
8	GND	-	Ground return and shield
9	EncA+/EncA	I	Encoder A+ diff. input or single-ended input
10	EncA-	I	Encoder A- diff. input. Leave open for single-ended; Add externally 120Ω to pin 9 for differential
11	EncB+/EncB	I	Encoder B diff. input or single-ended input
12	EncB-	I	Encoder B- diff. input. Leave open for single-ended; Add externally 120Ω to pin 11 for differential
13	...		
16	Rsvd.	-	Reserved. Do not use.
17	EncZ+/EncZ	I	Encoder Z+ diff. input or single-ended input
18	EncZ-	I	Encoder Z- diff. input. Leave open for single-ended; Add externally 120Ω to pin 17 for differential
19	USB DM	I/O	USB data-
20	USB DP	I/O	USB data+

No.	Name	Color	Description
LED1	TML ERR	RED	Turned on when the drive detects an error condition.
LED3	TML RDY	GREEN	Lit after power-on when the drive initialization ends. Turned off when an error occurs.

Pin	Name	Type	Description
1, 2	Rsvd.	-	Reserved. Do not connect.
3	TML RDY	O	Lit after power-on when the drive initialization ends. Turned off when an error occurs. Active high, LV-TTL.
4	TML ERR	O	Turned on when the drive detects an error condition. Active high, LV-TTL.
5, 6	Rsvd.	-	Reserved. Do not connect.

AxisID register									
MSB	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	LSB
ID2			ID1			ID0			
Nominal[V]	Minimum[V]	Maximum[V]	IDx* Bits	IDx* Value					
0.000	0.00	0.53	000	0					
1.06	0.53	1.41	001	1					
1.76	1.41	2.01	010	2					
2.25	2.01	2.43	011	3					
2.60	2.43	2.75	100	4					
2.89	2.75	3.01	101	5					
3.13	3.01	3.22	110	6					
3.32	3.22	3.30	111	7					

- Remarks:**
- If Bit 7 (ID2) = 1 -> TMLCAN mode is selected
 - If Bit 7 (ID2) = 0 -> CANopen mode is selected
 - Bit 8 (MSB of ID2) is ignored, and always considered as "0"
 - The maximum AxisID value is 127 (Bit 0 ... Bit 6)
 - TMLCAN mode: AxisID = (64*ID2_Value - 128) + (8*ID1_Value) + ID0_Value
 - CANopen mode: AxisID = (64*ID2_Value) + (8*ID1_Value) + ID0_Value
 - If all "IDx" pins are left not connected or connected to GND, the AxisID value is 255 and CANopen mode is selected. In this case, the drive will be in "LSS inactive" state and the Green LED will flash at 1 second intervals
- * where "x" can be 0, 1 or 2

- Electrical characteristics**
- All parameters measured under the following conditions (unless otherwise specified):
- V_{LOG} = 24 VDC; V_{MOT} = 48 VDC; F_{PWM} = 20 kHz
 - Ambient temperature = 25°C (typical values) / 0°C...40°C (min/max values)
 - Supplies start-up / shutdown sequence: -any-
 - Load current = nominal

Operating Conditions	Min.	Typ.	Max.	Units		
Ambient temperature	0		40 ^{1,2}	°C		
Ambient humidity	Non-condensing		90	%Rh		
Altitude / pressure ³	Altitude (vs. sea level)	-0.1	0 + 2.5 ³	Km		
	Ambient Pressure	0 ²	0.75 + 1	10.0 atm		
Storage Conditions	Min	Typ	Max	Units		
Ambient temperature	-40		100	°C		
Ambient humidity	Non-condensing		100	%Rh		
Ambient Pressure	0		10.0	atm		
ESD capability (Human body model)	Not powered; applies to any accessible part		±0.5	kV		
	Original packaging		±15	kV		
Mechanical Mounting	Min	Typ	Max	Units		
Airflow	natural convection ² , closed box					
Spacing required for horizontal mounting ²	Between adjacent drives		10	mm		
	Between drives and nearby walls		10	mm		
	Space needed for drive removal		20	mm		
	Between drives and roof-top		30	mm		
Insertion force	Using recommended mating connectors			40	N	
Extraction force				8	N	
Logic Supply Input (+V _{LOG})	Min	Typ.	Max.	Units		
Supply voltage	Nominal values		6	24	48	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		4.9		60	V _{DC}
	Absolute maximum values, continuous		-0.5		63	V _{DC}
Supply current	+V _{LOG} = 12V		90	150	mA	
	+V _{LOG} = 24V		60	90		
	+V _{LOG} = 48V		45	60		
Utilization category	Acc. to 60947-4-1(I _{PEAK} ≤ 1.05*I _{NOM})			DC-1		

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings
² In case of forced cooling (conduction or ventilation): a) the ambient temperature requirements may be extended substantially as long as the drive (PCB) temperature is kept below 85 °C; b) the spacing requirements can be dropped down to zero; c) the surface temperature will decrease accordingly

³ Micro 4804 can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

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Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units	
Supply voltage	Nominal values	7		48	V _{DC}	
	Absolute maximum values, drive operating but outside guaranteed parameters	6		60	V _{DC}	
	Absolute maximum values, continuous	-0.5		63	V _{DC}	
Supply current	Idle		0.3		mA	
	Operating	-16	±7	+16	A	
Voltage measurement error			±0.15	±0.25	V	
Utilization category		Acc. to 60947-4-1 (I _{PEAK} ≤ 4.0 * I _{NOM})				
Environmental Characteristics						
Size (Length x Width x Height)		Global size		38.1 x 25 x 9.6	mm	
Weight				~1.5 x 1 x 0.4	inch	
Cleaning agents		Dry cleaning is recommended		8	g	
Protection degree		According to IEC60529		IP20	-	
Power dissipation	Idle (I _{MOT} = 0A)		1	1.2	W	
	Full power (I _{MOT} = nominal)		2.0	2.4	W	
Power efficiency	Full power (I _{MOT} = nominal)		98.7		%	
	f _{PWM} = 20KHz		98.3		%	
Voltage efficiency	f _{PWM} = 100KHz		91.4		%	
	Idle (I _{MOT} = 0A)		55		%	
Surface temperature ¹	Full power (I _{MOT} = nominal)			100	°C	
					°C	
Supply Output (+5V)						
Output voltage	Current sourced = 400mA	5.05	5.2	5.25	V	
Output current	Output voltage ≥ 4.85V			1,200	mA	
Short-circuit to GND protection		Yes / Drive resets at event				
Over-voltage protection		NOT protected				
ESD protection	Human body model	±1			kV	
Motor Outputs (A/A+, B/A-, C/B+, CR/B-)						
Nominal current ²	PMSM motors sinusoidal amplitude			±6.3	A	
	PMSM motors sinusoidal RMS			4.5	A _{RMS}	
	DC/BLDC/STEP motors continuous			5.5	A	
Peak current	maximum 4 seconds	-16		+16	A	
Short-circuit protection threshold			±25	±28	A	
Short-circuit protection delay		2.6		3.5	µs	
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		50	70	V	
Off-state leakage current			0.3	1	mA	
Current measurement	Accuracy (FS = Full Scale)		±1	±1.5	%FS	
	Noise (current ≤ 2A)		±4	±6	mA	
	Noise (current ≥ 2A)		±30	±50	mA	
	Offset drift (compensated @ AxisOn)			±0.16	mA/°C	
Motor inductance (phase-to-phase)	Recommended value to avoid spurious short-circuit protection, triggered by ripple	Fast loop ³ V _{MOT}	50µs	48V	133	µH
			100µs	48V	266	µH
			50µs	24V	66	µH
			100µs	24V	133	µH
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	F _{PWM} = 20 kHz		330	µs	
		F _{PWM} = 40 kHz		170	µs	
		F _{PWM} = 60 kHz		140	µs	
		F _{PWM} = 80 kHz		80	µs	
		F _{PWM} = 100 kHz		66	µs	
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5/ENA)						
Mode compliance		NPN (sink)				
Default state		Input floating (wiring disconnected) Logic HIGH				
Input voltage	Logic "LOW"	IN0, IN1, IN4, IN5/ENA		1.4	1.8	V
				3.1	2.5	
				0.9	1.1	
	Logic "HIGH"	IN2/LSP, IN3/LSN		1.4	1.6	
				4	3.5	
	Hysteresis				0.6	
	Floating voltage (not connected)				4.7	
Input current	Absolute maximum, continuous	IN2/LSP, IN3/LSN, IN5/ENA	IN0, IN1, IN4	-2	+80	
					-0.5	V _{LOG} +0.5
Logic "LOW"; Pulled to GND			6.5	8	mA	
Logic "HIGH"; Pulled to +24V			0.2	0.4	mA	
Input frequency			0	500	kHz	
Minimum pulse			1		µs	
ESD protection - Human body model			±2		kV	

Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units	
Mode compliance		TTL / CMOS / Open-collector (NPN sink), or analog (linear) 0...5V				
Default state		Input floating (Wiring disconnected)				
Input voltage	Digital	Logic "LOW"	4.5	4.8	5.2	
		Logic "HIGH"		1.5	1.7	
	Hysteresis		3	2.5	0.5	
Analog		0	0.5...4.5	4.95		
Input current	Logic "LOW"; Pulled to GND		2.4		mA	
	Logic "HIGH"; Internal 2.2KΩ pull-up to +5		0		mA	
Minimum pulse width			66		µs	
ESD protection - Human body model			±15		kV	
Digital Outputs (OUT0, OUT1, OUT4)						
Mode compliance		NPN (sink) 24V				
Load type		Resistive, Inductive				
Default state		Not supplied (+V _{LOG} floating) High-Z (floating)				
Immediately after power-up		Logic "HIGH"				
Output voltage	Logic "LOW"; output current = 1.5A for OUT0/0.05A for OUT1, OUT4				0.4	
	Logic "HIGH"; output current = 0, no load		4	4.7	5.2	
	Logic "HIGH"; external load to +V _{LOG}			V _{LOG}		
	Absolute maximum, continuous (free-wheeling diodes to +V _{LOG} to GND)		-0.5		V _{LOG} +0.5	
Absolute maximum, surge (duration ≤ 1s) [†]		-1		V _{LOG} +1		
Output current	Logic "LOW", sink current, short duration, duty cycle ≤ 1%	5s max			0.1	
		0.5s max			2	
	Logic "LOW", sink current, continuous; V _{OUT} ≤ 0.4V					0.15
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V					2.5
	Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		V _{LOG} =24V	0.18	0.2	0.05
		V _{LOG} =48V	0.42	0.45	1.5	
Minimum pulse width			0.5		µs	
ESD protection - Human body model			±25		kV	
Encoder Inputs (A+, A-, B+, B-, Z+, Z-) ⁴						
Single-ended mode compliance		Leave A-, B-, Z- floating		TTL / CMOS / Open-collector (NPN sink)		
Single-ended threshold		A+, B+, Z+	1.3	1.4	1.5	
Single-ended input current		Input pulled to GND against on-board 2.2 KΩ pull-up to +5V		2.4	2.7	
Differential mode compliance		For full RS422 compliance, see ¹ TIA/EIA-422-A				
Input voltage	Hysteresis		±0.03	±0.05	±0.2	
	Differential mode		-15		+15	
	Common-mode range (A+ to GND, etc.)		-7		+12	
Input impedance, differential	Common-mode (A+ to GND, etc.)			2.2	kΩ	
	Differential (A+ to A-, etc.)			4.4	kΩ	
Input frequency		Differential mode	0	15	MHz	
Minimum pulse width		Differential mode	33		ns	
ESD protection		Human body model	±30		kV	
TTL2TX, TTL2RX						
Compliance		Hardware Software		LV-TTL (low-voltage TTL) RS-232		
Input Voltage	Mark (idle, stop-bit) level		2.0	3.3	V	
	Space (active, start-bit) level			0	1.1	
	Absolute maximum, continuous		-0.5		3.8	
Input current				±0.15	mA	
Output voltage		Mark (idle, stop-bit) level		2.4	3.3	
		Space (active, start-bit) level			0	
Output current				±2	mA	
Short-circuit protection		NOT protected				
ESD protection		Human body model		±250	V	
CAN-Bus						
Compliance		CAN 2.0B, ISO 11898-2				
Software protocols compatibility		CiA301, CiA305, CiA402, TechnoCAN, TMLcan				
Bit rate		Software selectable		125, 250, 500, 1000	KBaud	
Node addressing		TMLcan		1 + 255	-	
		CANopen		not configured, 1 + 127	-	
Voltage	Common-mode, operating		-12		+12	
	Common-mode, max. continuous		-58		+58	
	Differential, max. continuous		-45		+45	
Input impedance	Differential		40		90	
	Common-mode		20		45	
Termination resistor (120Ω)		NOT included				
ESD protection		Human body model		±10	kV	

¹ In case of forced cooling (conduction or ventilation): a) the ambient temperature requirements may be extended substantially as long as the drive (PCB) temperature is kept below 85 °C; b) the spacing requirements can be dropped down to zero; c) the surface temperature will decrease accordingly
² For current values >4A_{RMS}, pins J1/2...8 may need to be soldered instead of socketed, for long-term reliability - check socket manufacturer specifications.

³ Fast loop period of 50µs is not possible with all feedback device types.

⁴ Full RS-422 compatibility, as well as noise rejection improvement requires an external 120Ω resistor connected across each signal pair (A+/A-, B+/B-, Z+/Z-)

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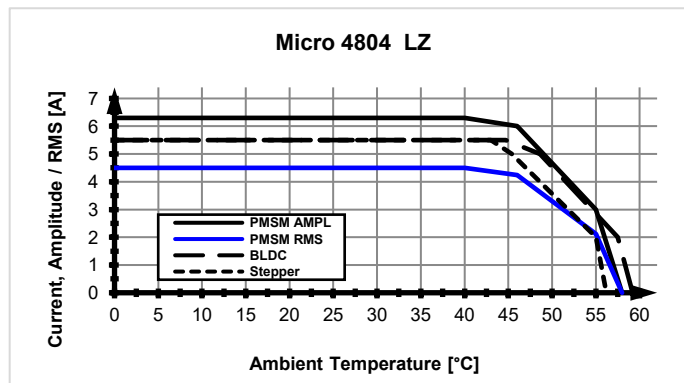
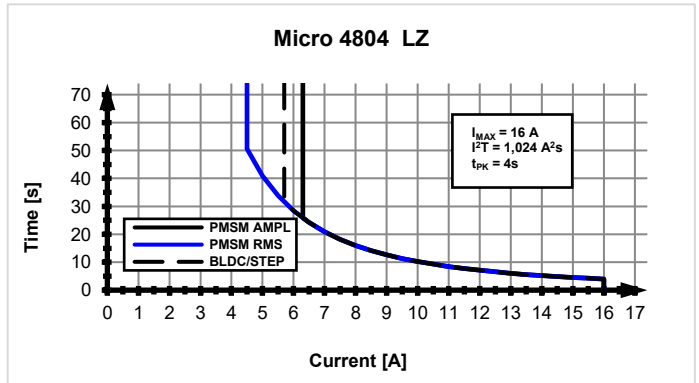
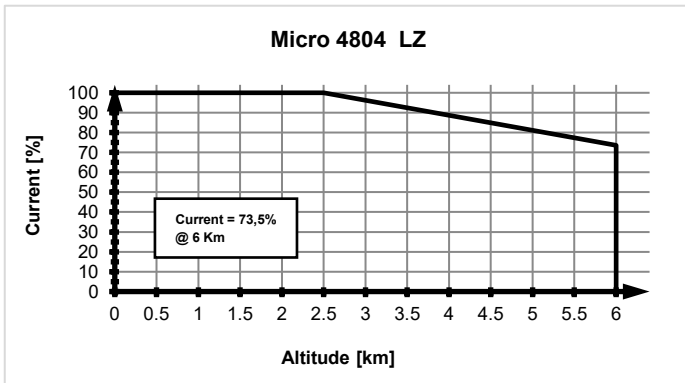
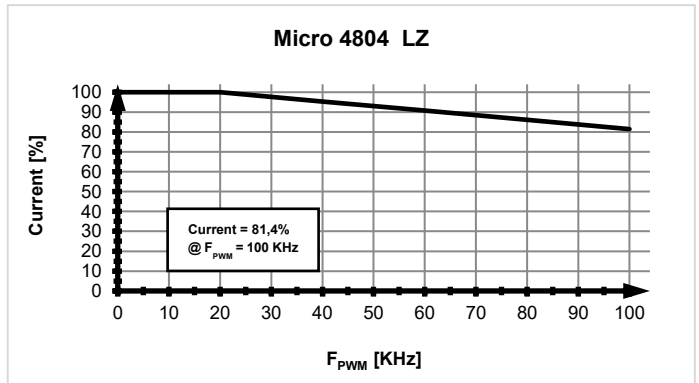
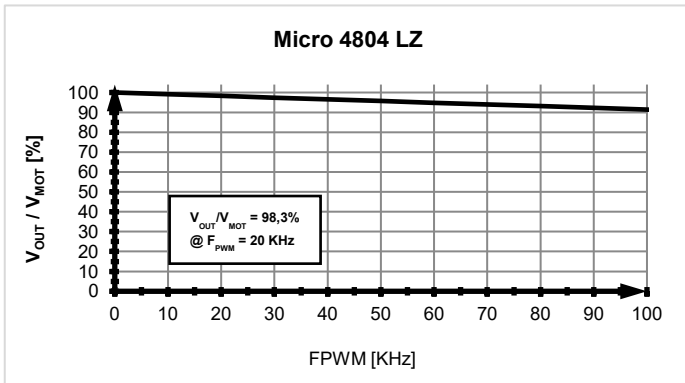


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Analog Input (REF/ FDBK)		Min	Typ.	Max	Units
Input voltage	Operational range	0...5, -10...+10			V
	Absolute maximum values, continuous	-22		+26	
	Absolute maximum, surge (duration ≤ 1s)			±38	
Input impedance	To 1.44V		20		kΩ
Bandwidth (-3dB)	Software selectable	0		5.3	kHz
Resolution			12		bits
Integral linearity				±1	bits
Offset error	Range -10V ... +10V		±3	±10	bits
	Range 0 ... +5V		±10	±30	
Gain error	Range -10V ... +10V		±0.3	±0.5	%
	Range 0 ... +5V		±0.5	±0.8	
ESD protection	Human body model	±1.5			kV
LED outputs		Min.	Typ.	Max.	Units
Polarity	Active high (high=LED lit)				
	Common cathode to GND				
Voltage	$I_{OH} \leq 0.9mA$	2.9	3.3		V
	$I_{OH} \leq 1.5mA$	2.4			V
	$I_{OL} \leq 2.0mA$		0	0.4	V
	Abs. max., continuous	-0.5		3.8	V
Current	Sink (I_{OL}) current larger than source (I_{OH}) current	-2.0		+1.5	mA
Short-circuit protection		NOT protected			
ESD protection	Human body model		±250		V

AxisID inputs		Min.	Typ.	Max.	Units
Default state	ID1, ID1, ID2 floating	Configured Station Alias = 0, AxisID=255			
Internal pull-down to GND		95	100	105	kΩ
ESD protection	Human body model		±250		V
BFS input		Min.	Typ.	Max.	Units
Polarity		Active Low (0=fail-safe boot, 1=normal)			
Default state	BFS floating	High			
	Logic low (active)		0	1.1	V
Voltage	Logic high (inactive)	2.0	3.3		V
	Abs. max., continuous	-0.5		3.8	V
	Logic low (2.2KΩ pull to +3.3V)		1.5	1.6	mA
Current	Logic high		0		mA
ESD protection	Human body model	±250			V

† Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



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